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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventor:	Genichiro OTA et al.	Art Unit 2611
Appln. No.:	10/565,380	Exr. K. Timory
Filed:	January 23, 2006	Conf. No. 5562
For:	MODULATION APPARATUS, DEMODULATION APPARATUS, MODULATION METHOD AND DEMODULATION METHOD	

AMENDMENT UNDER 37 CFR §1.116 AND SUPPLEMENTAL SUMMARY OF SUBSTANCE OF TELEPHONE INTERVIEW

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Office Action dated July 28, 2011 and supplemental to the Summary of Substance of Telephone Interview filed on July 26, 2011, the following amendments and remarks are respectfully submitted:

IN THE CLAIMS

Listing of Claims

1. (Currently Amended) A modulation apparatus comprising:

a first frequency-increasing single side band (SSB) modulator that performs SSB modulation on a first input symbol to obtain an upper side band (USB) signal;

a second frequency-increasing SSB modulator that performs the SSB modulation on a second input symbol to obtain a lower side band (LSB) signal; and

a combiner that combines the USB signal and the LSB signal,

wherein the second frequency-increasing SSB modulator performs SSB modulation to obtain the LSB signal using a carrier frequency, the carrier frequency being higher than a carrier frequency used in the first frequency-increasing SSB modulator by a symbol frequency of the first input symbol and the second input symbol, such that the LSB signal and the USB signal are multiplexed in the same frequency band,

wherein the first frequency-increasing SSB modulator comprises a first Hilbert transformer and obtains the USB signal by multiplying a signal output from the first Hilbert transformer by a signal comprising a sine curve with a frequency $(\omega_{1(\text{first})} - \omega_{0(\text{first})}/2)$,

wherein the second frequency-increasing SSB modulator comprises a second Hilbert transformer and obtains the LSB signal by multiplying a signal output from the second Hilbert transformer by a signal comprising a sine curve with a frequency $(\omega_{1(\text{second})} + \omega_{0(\text{second})}/2)$, and

wherein $\omega_{0(\text{first})}$ is the symbol frequency of the first input symbol, $\omega_{0(\text{second})}$ is the symbol frequency of the second input symbol, $\omega_{1(\text{first})}$ is the carrier frequency used in the first

frequency-increasing SSB modulator, and $\omega_{1(second)}$ is the carrier frequency used in the second frequency-increasing SSB modulator.

2. (Withdrawn) A demodulation apparatus comprising:

a first frequency-decreasing demodulator that demodulates an input modulation signal by a cosine curve with a predetermined carrier frequency to obtain a first demodulation signal; and

a second frequency-decreasing demodulator that demodulates an input modulation signal by a sine curve with a carrier frequency higher than the carrier frequency used in the first frequency-decreasing demodulator by the symbol frequency of a symbol.

3. (Withdrawn) A demodulation apparatus comprising:

a detector that performs quadrature detection on an input modulation signal by a predetermined carrier frequency to obtain a first detection signal and a second detection signal;

an analog/digital converter that quantizes the first detection signal and the second detection signal with an over-sampling frequency four times or more an entire bandwidth of the detection signal;

a FFT circuit that performs Fourier transform on the first detection signal and the second detection signal quantized; and

a signal detector that detects a signal before being modulated based on an output signal of the FFT circuit, using a signal in each carrier frequency and another signal in an adjacent frequency on a USB or LSB side.

4. (Currently Amended) A modulation method comprising:

an upper side band (USB) signal forming step of performing single side band (SSB) modulation on a first input symbol to obtain a USB signal;

a lower side band (LSB) signal forming step of performing the SSB modulation on a second input symbol to obtain an LSB signal; and

a combining step of combining the USB signal and the LSB signal,

wherein, in the LSB signal forming step, the SSB modulation is performed using a carrier frequency, the carrier frequency being higher than a carrier frequency used in the USB signal forming step by a symbol frequency of the first input symbol and the second input symbol, such that the LSB signal and the USB signal are multiplexed in the same frequency band,

wherein the USB signal forming step comprises obtaining the USB signal by multiplying a signal output from a first Hilbert transformer by a signal comprising a sine curve with a frequency $(\omega_{1(first)} - \omega_{0(first)}/2)$,

wherein the LSB signal forming step comprises obtaining the LSB signal by multiplying a signal output from a second Hilbert transformer by a signal comprising a sine curve with a frequency $(\omega_{1(second)} + \omega_{0(second)}/2)$, and

wherein $\omega_{0(first)}$ is the symbol frequency of the first input symbol, $\omega_{0(second)}$ is the symbol frequency of the second input symbol, $\omega_{1(first)}$ is the carrier frequency used in the USB signal forming step, and $\omega_{1(second)}$ is the carrier frequency used in the LSB signal forming step.

5. (Withdrawn) A demodulation method comprising:

a first demodulation step of demodulating a modulation signal by a cosine curve with a predetermined carrier frequency to obtain a first demodulation signal; and

a second demodulation step of demodulating a modulation signal by a sine curve with a carrier frequency higher than the carrier frequency used in the first demodulation step by the symbol frequency of an symbol.

6. (Previously Presented) A demodulation apparatus for demodulating a signal combined by the combiner in the modulation apparatus according to claim 1, the demodulation apparatus comprising:

a first frequency-decreasing demodulator that demodulates an input modulation signal by a cosine curve with a first carrier frequency to obtain a first demodulation signal; and

a second frequency-decreasing demodulator that demodulates the input modulation signal by a sine curve with a second carrier frequency to obtain a second demodulation signal, wherein

the second carrier frequency is higher than the first carrier frequency by the symbol frequency of the first input symbol and the second input symbol.

Claim 7 (Cancelled).

8. (Previously Presented) A demodulation method of demodulating a signal combined in the combining step of the modulation method according to claim 4, the method comprising:

a first demodulation step of demodulating a modulation signal by a cosine curve with a first carrier frequency to obtain a first demodulation signal; and

a second demodulation step of demodulating the modulation signal by a sine curve with a second carrier frequency to obtain a second demodulation signal, wherein

the second carrier frequency is higher than the first carrier frequency by the symbol frequency of the first input symbol and the second input symbol.

9. (Previously Presented) The modulation apparatus of claim 1, wherein the symbol frequency of the first and second input symbols is the bandwidth of each of the first and second input symbols.

10. (Previously Presented) The modulation apparatus of claim 9, wherein the frequency band into which the LSB and USB signals are both multiplexed has the same bandwidth as each of the first and second input symbols.

11. (Previously Presented) The modulation method of claim 4, wherein the symbol frequency of the first and second input symbols is the bandwidth of each of the first and second input symbols.

12. (Previously Presented) The modulation method of claim 11, wherein the frequency band into which the LSB and USB signals are both multiplexed has the same bandwidth as each of the first and second input symbols.

REMARKS

Reconsideration and allowance of this application are respectfully requested in light of the above amendments and the following remarks.

Applicants acknowledge with appreciation the indication in the Office Action that claims 9-12 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Supplemental to the Summary of Substance of Telephone Interview filed on July 26, 2011, the Applicants have amended independent claims 1 and 4 in the manner agreed upon to overcome the current rejections. Specifically, claim 1 has been amended and now recites the features of:

> "1. (Currently Amended) A modulation apparatus comprising:
>
> a first frequency-increasing single side band (SSB) modulator that performs SSB modulation on a first input symbol to obtain an upper side band (USB) signal;
>
> a second frequency-increasing SSB modulator that performs the SSB modulation on a second input symbol to obtain a lower side band (LSB) signal; and
>
> a combiner that combines the USB signal and the LSB signal,
>
> wherein the second frequency-increasing SSB modulator performs SSB modulation to obtain the LSB signal using a carrier frequency, the carrier frequency being higher than a carrier frequency used in the first frequency-increasing SSB modulator by a symbol frequency of the first input symbol and the second input symbol, such that the LSB signal and the USB signal are multiplexed in the same frequency band,
>
> wherein the first frequency-increasing SSB modulator comprises a first Hilbert transformer and obtains the USB signal by multiplying a signal output from the first Hilbert transformer by a signal comprising a sine curve with a frequency $(\omega_{1(first)} - \omega_{0(first)}/2)$,

wherein the second frequency-increasing SSB modulator comprises a second Hilbert transformer and obtains the LSB signal by multiplying a signal output from the second Hilbert transformer by a signal comprising a sine curve with a frequency ($\omega_{1(second)} + \omega_{0(second)}/2$), and

wherein $\omega_{0(first)}$ is the symbol frequency of the first input symbol, $\omega_{0(second)}$ is the symbol frequency of the second input symbol, $\omega_{1(first)}$ is the carrier frequency used in the first frequency-increasing SSB modulator, and $\omega_{1(second)}$ is the carrier frequency used in the second frequency-increasing SSB modulator."

Support for the amendments is provided, for example, in paragraphs [0064]-[0069] and FIG. 5 of the published U.S. application.

As agreed upon during the telephone interview conducted on July 26, 2011, neither Daoud et al. (US 4,835,791) nor Muzzi et al. (US 3,628,155), whether considered individually or in combination, teach or suggest the above-noted features recited by amended claim 1.

Accordingly, the Applicants submit that the teachings of Daoud and Muzzi, even if combined as proposed in the Office Action, still would lack the above-noted subject matter of claim 1 and thus these references, considered individually or in combination, do not render obvious the subject matter defined by claim 1. Claim 4 has been amended and now similarly recites the above-mentioned subject matter distinguishing apparatus claim 1 from the applied references, but with respect to a method. Therefore, allowance of claims 1 and 4 and all claims dependent therefrom is warranted.

In view of the above, it is submitted that this application is in condition for allowance, and a notice to that effect is respectfully solicited.

If any issues remain which may best be resolved through a telephone communication, the Examiner is requested to telephone the undersigned at the local Washington, D.C. telephone number listed below.

Respectfully submitted,

/James Edward Ledbetter/

Date: October 28, 2011
JEL/DEA/att

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